PROJECT PURPOSE AND SCOPE

The purpose of this project is to remove the water from Pond 207A and Ponds 207B North, Center, and South by a mechanical/thermal forced evaporation process.

The scope of this project is to install a mechanical/thermal forced evaporation system which consists of a vapor compression (VC) unit installed in series with a multiple–effect multiple–stage (MEMS) flash evaporator. There will be three identical systems connected in parallel combined with the feed, distillate, and concentrate handling equipment to form a complete operation.

FACILITY DESCRIPTION

Background

Building 910, located south of Pond 207B South, will be used to house the forced evaporation equipment. This building was originally constructed for a Reverse Osmosis (RO) system to treat Rocky Flats Plant sanitary effluent.

General

The location of Building 910 and its existing tank storage capacity made it the optimal location for the evaporation equipment. Building 910 is a concrete structure with concrete floors and roof. On the main floor of Building 910, there are two rooms that will be used: the Process Room and Chemical Prep Room. The lower level (basement) of Building 910 contains holding tanks for the evaporator products. Some equipment in Building 910 is being stripped out to accommodate the evaporation equipment. All existing equipment that will be reused for the evaporation project will be inspected and/or tested.

Main Floor Building 910

Process Room: The Process Room makes up the west part of Building 910. The RO equipment will be removed to provide room for the evaporation equipment. There will be three evaporators, each consisting of a vapor compression (VC) unit and a multiple–effect, multiple-stage (MEMS) flash evaporator. A natural gas generator located outside Building 910 will provide electrical power to the VC and exhaust heat to the MEMS. All of the doorways into this room will have berms across them and the floors will be coated to provide secondary containment. See attached Drawing 39365-404 for floor layout. This area will be equipped with a wet fire suppression system.

Chemical Prep Room: The Chemical Prep Room makes up the south corner of Building 910. The room contains chemical mixing tanks and will be used as part of the evaporation system. The west side of this room will also be used for the storage of the scale inhibitor and descaling chemicals. The east side of this room will be used as a laboratory, which will consist of radiochemical analysis equipment, pH and nitrate meter, and conductivity meter. The emergency showers and eye wash are located in this room. All of

the doorways will have berms across them, and the floors will be coated with a sealant to provide secondary containment. See attached Drawing 39365-404 for floor lay-out.

Lower Level Building 910

Six tanks will be used on this level as temporary holding tanks for the evaporation products. The distillate will be held in Tanks D-2, D-6, and D-7. The concentrate will be held in Tanks D-9 and D-18. Tank D-10 will be used as a surge tank for the condensate system. Pumps for recirculation and transfer of materials will be located on this level. Most of the pumps used will be new. The floor and sump of the lower level will be sealed to serve as secondary containment for all the equipment within the building. The sump will be reconfigured, if necessary, to ensure sump liquids are not discharged outside the containment of Building 910. The containment volume will be at least as large as the volume of the largest tank located within Building 910. See attached Drawing 39365-405 for floor layout.

Auxiliary Equipment

Each of the 207A and 207B Solar Ponds will have a pump inside the berm connected to a double containment pipe to supply water to the evaporators.

Tank 215-D, which has a capacity of 500,000 gallons, is located to the west of Building 910, north of Building 928. This tank will be used as a surge tank for the distillate in case the raw water or condensate systems temporarily have no demand for the distillate.

A portable cooling tower, which will provide cooling water to the portable evaporation system, will be located outside of Building 910.

PROCESS DESCRIPTION (see attached conceptual flow diagram for reference)

The water from Pond 207A and Pond 207B North, Center, and South will be pumped through a manifold station equipped with duplex strainers and duplex filters, via a double–pipe transfer line which will connect to the VC. The brine produced by the VC will be fed to the MEMS flash evaporator.

The distillate will be collected from the VC unit and the MEMS flash evaporator unit into two separate small surge tanks. The distillate will then be discharged through an in–line conductivity monitor/controller. The monitor/controller will divert the distillate into the recycle tank for reprocessing when the conductivity level exceeds the setpoint of 150 micro mho/cm. When below 150 micro mho/cm, the distillate will be discharged into an approximately 7,000 gallon capacity batch tank. Simultaneously, an automatic composite sampling process will also be initiated. When the accumulated distillate level reaches the high–level setpoint, the composite sample will be sent for laboratory analysis. Upon receipt of satisfactory test results, the distillate will then be transferred to the 500,000 gallon distillate surge tank. From that tank, the distillate will be injected into the Raw Water System for plant cooling tower usage on a demand basis. The concentrate from the MEMS flash evaporator will be collected in concentrate holding tanks before being transferred to

the pondcrete cementation process or Building 374 saltcrete process. A composite sample of the concentrate will be manually collected for analysis.

Process Performance

Each portable evaporator system (VC unit in series with MEMS flash evaporator) has a designed output of 18,000 gallons per day. There will be three identical systems installed in parallel so that an operator can operate any combination of the three systems simultaneously. The system will be capable of producing a product water quality of 150 micro mho/cm or better and a final concentrate with total dissolved solids (TDS) ranging between approximately 300,000 ppm to 400,000 ppm from feed water that has an average TDS of approximately 6,000 ppm.

Logistics of Pond Water Removal

The portable evaporator system will have the capability to treat the water from one pond or a combination of ponds. However, neither treated pond water nor byproduct from the evaporator will be returned to any of the four ponds (except during the initial verification of the evaporators). During initial verification, the water may be discharged to the pond from which it came. That is necessary to prevent contamination of the 500,000 gallon distillate surge tank in case the distillate is unacceptable for reuse in the raw water or condensate systems.

Distillate Disposition Plan

Upon receipt of satisfactory test results, distillate will be held in Tank 215-D (500,000 gallon capacity). From there, the distillate will be pumped into the Raw Water header on a demand basis by a centrifugal pump. The distillate injected into the Raw Water Header will be reused by plant cooling towers.

In the event that plant cooling tower consumption falls below a normal rate, the distillate can be pumped into the condensate return header through the condensate receiver, which is located in Building 910. That will allow the distillate to be discharged into the 300,000 gallon condensate tank located in Building 443 for the use as plant boiler feed. This transfer will interrupt the normal supply of boiler feed water from the Building 374 evaporator until the cooling tower consumption rate returns to normal.

Concentrate Disposition Plan

The concentrate will be collected in the concentrate holding tank and will also be sampled for waste characteristic data before being transferred to the pondcrete cementation process or to the Building 374 saltcrete process.

Flow, Level and Spill Control

The main feed stream, final distillate stream, and the final concentrate streams will be monitored for flow rate and will have a continuous flow indication (or readout) of the total volume transferred. All collection tanks and holding tanks will be equipped with a level

control to prevent overflow of liquid. In addition, there will be secondary containment provided to all in-building collection tanks. The 500,000 gallon distillate surge tank will not have secondary containment. However, it will be equipped with a high level alarm and a secondary high level alarm. The high level alarm is for precautionary action. The secondary high level alarm will automatically shut down the transfer pumps that feed into the 500,000 gallon holding tank.

SAMPLING AND ANALYTICAL SUMMARY

The purpose of the sampling plan is to ensure the distillate will be an effective substitute for water used in the raw water system. In addition, since raw water is discharged to the sewage treatment plant after it is used, the sampling must demonstrate that the distillate would have no adverse impact on the quality of the water discharged from the plant. The following sampling plan has been developed to satisfy those objectives.

a. A characterization of the water in each solar pond will be done as soon as possible. The parameters to be sampled will be a union of the parameters currently obtained during the monthly sampling of the Building 374 evaporator distillate (which is currently reused in the Building 374 cooling tower) and the sampling of water discharged from the plant.

b. Next, the evaporator's feed and distillate will be sampled during the initial performance verification of each portable evaporator. The parameters to be sampled will be based on the results of the pond characterization. Approximately three feed samples and three distillate samples will be obtained during a one-day trial run (approximately 20,000 gallons per day). To determine which ponds need to be included in the initial trial runs, the results of the characterization of each pond will be compared. An initial trial run will be conducted on each pond that contains the highest (worst case) concentration of each contaminant analyzed during the characterization.

c. If the distillate sampling results are unacceptable, the distillate will be discharged to the pond from which it came, and the evaporation process will be modified to correct the problem. Then additional sampling will be conducted to determine if the modified process provides acceptable distillate. When the distillate sampling results are acceptable, the evaporator will be allowed to operate and discharge to the raw water or condensate systems.

d. Monthly samples will be obtained from the 500,000 gallon distillate surge tank during operation of the portable evaporators. The parameters to be sampled will be a union of the parameters currently obtained during the monthly sampling of the Building 374 evaporator distillate and any other parameters found to be of concern during the initial verification. If the results show the distillate in the 500,000 gallon tank is unacceptable, the evaporation process will be shut down until the problem is found and corrected. In addition to that sampling, the 7,000 gallon batch tanks will be continuously sampled during operation for a limited number of parameters (e.g., pH and nitrates) to help ensure only acceptable distillate is sent to the 500,000 gallon tank. If the distillate in a 7,000 gallon tank is unacceptable, it will be fed back to the evaporator inlet for reprocessing.

The following table summarizes the sampling plan:

Sample/Location	Sampling Method	Frequency	Analytical Requirements
Feed water/solar pond	Per analysis plan	Initial start-up	Per analysis plan
Distillate/upstream of of the distillate batch tanks	In-line, automatic	Continuous monitoring	Conductivity (setpoint 150 micro mho/cm)
Distillate/inlet of distillate batch tanks	Composite, automatic	Each 7,000 gallon batch	Per analysis plan
Concentrate/concentrate holding tank	Composite, manual	Initial start-up	Per analysis plan
Concentrate/concentrate holding tank	Composite, manual	Routine	Per analysis plan
Distillate/500,000 gallon distillate surge tank	Grab, manual	Monthly	Per analysis plan

SAFETY FEATURES

Fire Protection and Safety Equipment

There will be a new wet fire suppression system installed to cover the entire building. Approximately five fire extinguishers will be provided throughout the entire building. Existing fire phones are adequate. Existing safety shower and eye wash equipment also adequately provide for personnel safety protection.

Alarms

The following is a list of alarms for both the process and personnel:

Process:

- Over temperature alarm - Audible
- High/low level alarm - Audible
- Power overload alarm - Audible
- Loss of vacuum alarm - Audible
- Low flow alarm - Audible
- Conductivity level high alarm - Visual

Personnel:

- Fire alarm - Audible

Inspection

Inspection requirements of the facility will comply with the approved procedures for operation of the system. A copy of the draft procedures will be available for review at the completion of equipment installation. A copy of the final procedures will be available after completion of the initial system verification. The tanks, containment systems, and ancillary piping will be inspected daily.

Operating Procedures

Operation of all equipment in this facility will follow the appropriate approved procedure. The following list of draft procedures that will be available for review at the time of the initial system verification test:

Equipment checkout/shakedown procedure
System acceptance test procedure
Outside equipment operating procedure
Evaporator operating procedure
Distillate transfer procedure
Concentrate transfer procedure
Chemical make-up procedure

Spill Response

The spill response will be in accordance with the plant spill response procedure.

PERSONNEL TRAINING

Rocky Flats Training

Industrial Safety
40-hour OSHA/Right to Know
Respirator
Annual RCRA Training

Evaporator

On-the-job training provided by the manufacturer during the initial trial run.